



Interception by a temperate coniferous forest and its relationship with wet canopy gas exchange

Keywords: Interception, Latent heat flux, Wet canopy, Gas exchange, Coniferous

Linjie Jiao*¹, Yuichi Sempuku^{1,2}, Ting-Wei Chang¹, Yoshiko Kosugi¹

¹:Graduate School of Agriculture, Kyoto University, Kyoto 606-8502, Japan; ²:East Nippon Expressway Company Ltd. Kanto Branch, Chiba, management office Chiba, 263-0001, Japan
correspondence to: jiao.Linjie.66x@st.yoto-u.ac.jp



Introduction

- Continuous observation of gas exchange from wet canopy is important for evaluating the forest water regime and carbon budget
- Broadleaf species have been proved able to process photosynthesis during the rainfall (Park and Hattori, 2014; Tanaka 2002)
- **However, possibility of interception by the both leaf surfaces of coniferous species and its relation to gas exchange during the rainfall has seldom been discussed**

in this study, we link interception and gas exchange of wet coniferous canopy by measuring and simulating the change of latent heat flux during and instantly after the rainfall

Methods

➤ **Eddy covariance: 29m** (energy budget correction finished)

- **3D anemometer** (SAT-550, Kaijo)
- **Enclosed IRGA** (LI-7200, Licor, **water proof**)



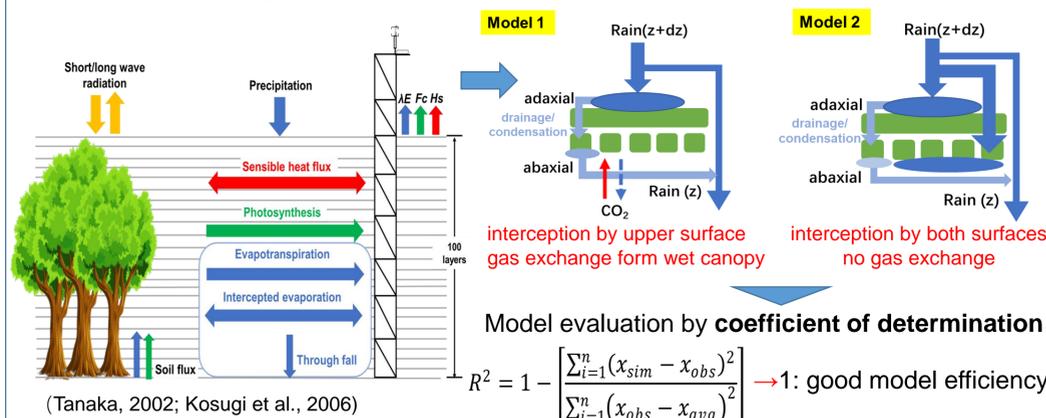
CO₂ flux (F_c)
Latent heat flux (λE)

➤ **Wetness sensor**

top layer: 19.4m (n=8)
middle layer: 18.6m(n=10)
bottom layer: 17.4m (n=6)
(10 sensors each layer before 2018/8/10)



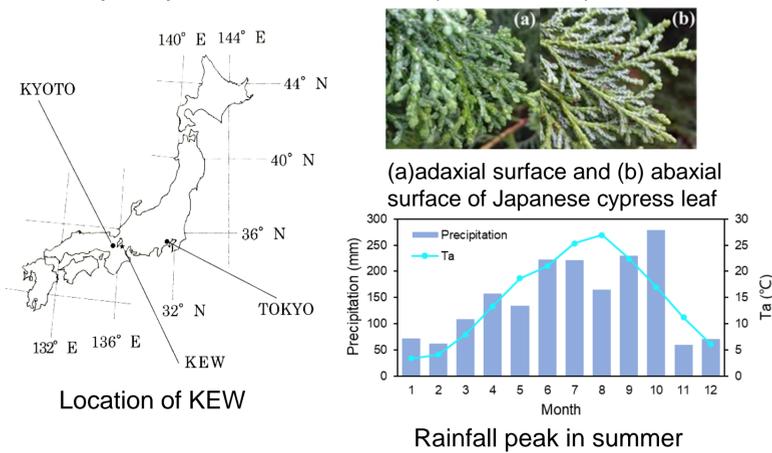
➤ **(SVAT) Multi-layer model with two interception solutions**



Site

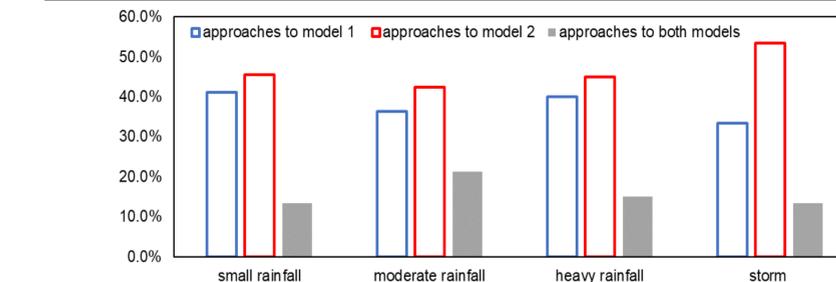
Kiryu Experimental Watershed (KEW)

- Location: the South of Shiga prefecture, Japan
- Vegetation : Japanese cypress (*Chamaecyparis obtuse*)
- Annual temperature: 13.6°C (2016-2019)
- Annual precipitation: 1784.5mm (2016-2019)



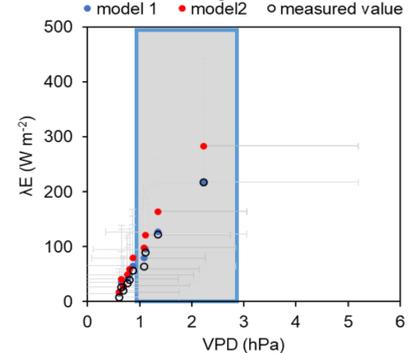
Model performance with different rainfall intensity

	intensity (mm/12h)	number of events	average R ² of model 1	average R ² of model 2
small rainfall	<5	90	0.36	0.31
moderate rainfall	5.0~12.5	33	0.43	0.45
heavy rainfall	12.5~25	20	0.37	0.40
storm	>25	15	0.11	0.16

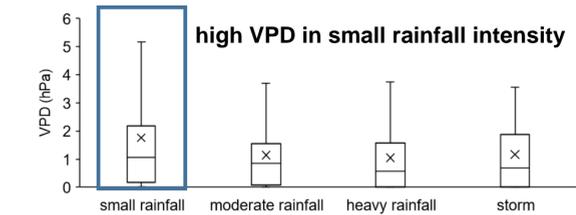


- Average R² of model 2 is larger than model 1 with higher rainfall intensity
- The percentage that model 2 approaches to measured λE improved with increasing rainfall intensity

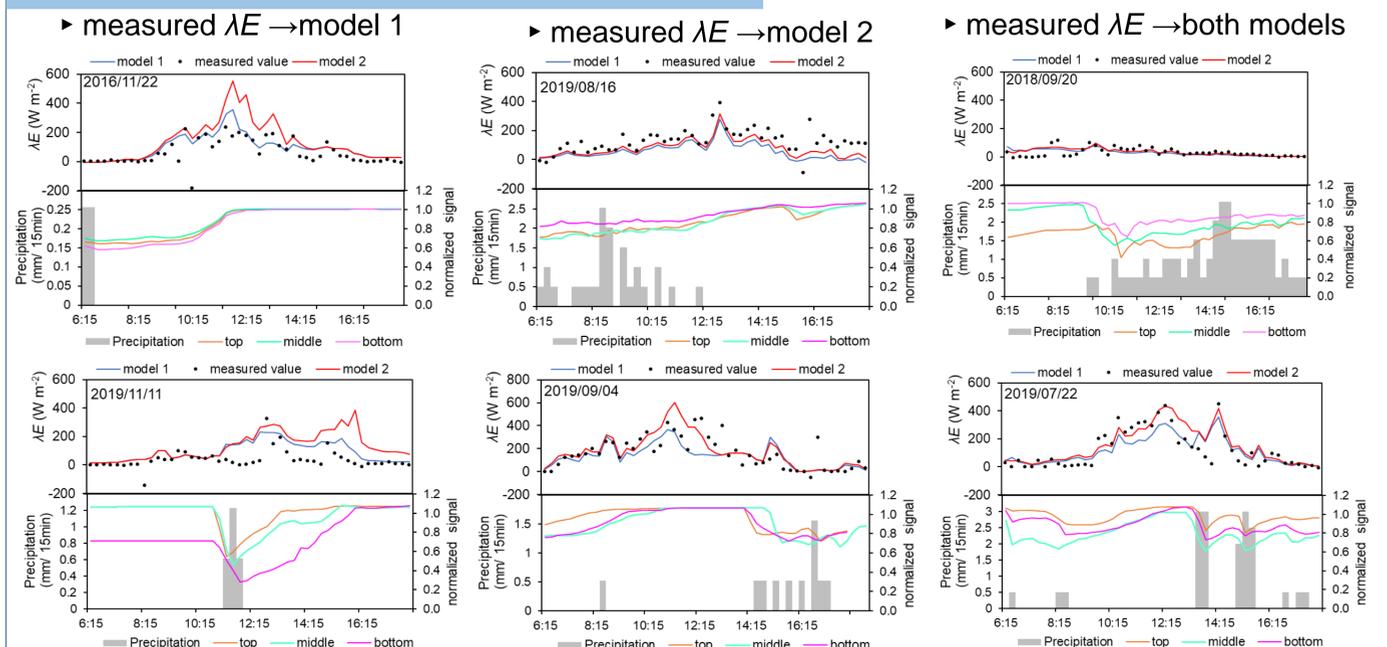
➤ **Relationship with VPD**



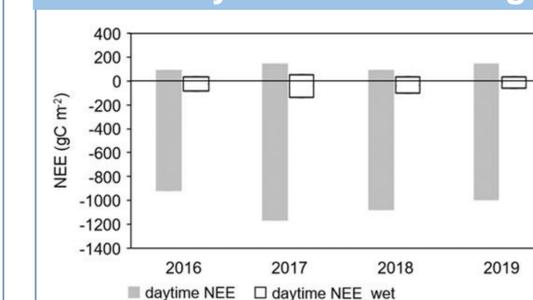
Model 1 is more precise when VPD is high



Time series of measured and simulated λE



Annual daytime carbon budget



- NEE from wet canopy only took a slice part from total daytime NEE but is still notable
- **Photosynthesis can be processed by the wet canopy of Japanese cypress**
- Variation of wet canopy carbon budget from different years may be caused by the time distribution of the rainfall

Conclusions

- Interception by both surfaces is more possible to happen in heavier rainfall
- Annual daytime carbon uptake sometime is more significant than emission from wet canopy

Future plan

- Compare with other type of tree species
- Continue measurements and simulation of snow periods